The Inter/trans-disciplinary balancing act: The exclusive/inclusive determinants, processes, and consequences that impact our socio-economic systems

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Abstract[2]

In order to understand present conditions and the complexities, a review of past thinking that links us to a range of future, emergent possibilities may be necessary. Financial, digital and social landscapes are seldom static and those with the responsibility of maintaining and striving for natural-socio-economic equilibrium, have a never-ending task of sweeping back a dynamic, systemic tide.

The undesirable impacts of an unbalanced ICT (information, communication technology) focus based progress was voiced almost two decades ago by Huesing and Selhofer (2002), an argument that was reflected in the term "info-exclusion". Observations regarding the digital age being "not so much as exclusion from information but rather by information" (ibid). This discussion relates purely to humans, not consider other species and other impacts.

Fast-forwarding to current experiences and observations, and we see how the close links between societal structures, financial landscapes and individuals currently interact. There seem to be echos from the past regarding basic questions of imbalance between the pace of ICT infrastructures, and the skills sets or accessibility of the societies it strives to service. This imbalance seems to suggest an emergent result, one of disconnection (Holt-Lunstad et al., 2015) but also cyclical, emergent impact (Nousala & Whyte, 2010) that repeats when the imbalance approaches a tipping point between the determining elements of the natural-socio-economic fabric.

Keywords: *socio-economic systems; socio-environmental systems, transdisciplinarity; natural-socio-economic fabric; inclusion*

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1. Introduction

Huesing and Selhofer (2002) argued that the idea of the "digital divide" concept was directly related to an unbalanced "spiral" (or cyclical) access and usage of information. Since 2002, ICT and its various applications and technical infrastructures have developed at pace. It was already a concern two decades ago that there would be an imbalance created by barriers between access of basic ICT skills sets, infrastructure and information policies that would keep in check the impacts of financial instruments that developed separately as linked processes that bundled to create systems within systems.

Viewed from a societal focal point, the question may now be how do we determined why what and which skill sets are currently required for a 21st-Century digital citizen? Vaidhyanathan (2018) points out that despite access to the ubiquitous digital ecosystems and services, people and society may be increasingly cognitively cut off with less access to financial market places regardless of the range of applications and new ICT structures coming into existence.

Similarly, the recent economic models have excluded nature, viewing it as a resource rather than actors within an ecosystem. For instance, when discussing the award of legal person-hood to Whanganui River in New Zealand, Hutchison (2014) points out that the environment in most legal systems does not have legal personhood status, but that corporations do. This is indicative of the fact that contemporary western societies see the natural world as being for-profit. As a result, the natural world is seen as property to be used and controlled (ibid). It is fair to say that the engagement with new types of biophysical environments that socio-economic systems operate within are isolating but also somewhat compulsory if individuals wish to sustain themselves (Kesebir & Kesebir, 2017). As a consequence, Walker and Salt (2006) state that these types of a social systems will display weakness or even disintegration, and a lack of socio-economic resilience, when exposed to shocks and disturbances within the broader financial structures. The possibilities of creating methodological approaches that observe emergent sets of characteristics would be of great interest to investigate, particularly to those within the behavioural, natural-socio-economic disciplines.

2. General Discussion

From an individual view point, the capacity for their community to operate and support a human-centered paradigm is greatly reduced when their own capacity to operate is subjected to unseen divides, prone to expansion and contractions, disturbing the balance of resilience for the individual within

the natural-socio-economic system (which is different again from the system itself). From the macro perspective, there can be a disconnection, that weakens any elemental, connective aspects from within and beyond the system, (including a social-ecological and physical system that are that are a part or connected). A system's component (or individual), that only has dysfunctional connections, is not only a hindrance, but can go on to impact the entire system as a whole. Eisenberger (2012) discussed that from an individual to the social level, any system can display connections or the disconnections of the individual (bottom-up or top-down), (Hutchins, 1995; Nousala & Hall, 2008).

While the progressive development of the digital age has for the last several decades, greatly increased our overall communication capacity it has also greatly reduced capacity of socio-economic exchanges as well (Twenge, 2013), specifically the digital divide (United Nations, 2019). Indeed research (Lyon, 2014) may have shown that better connections between the individual as well as the systems they rely on, have an increasing beneficial impact for the resilience of the individual and society. Is it then a question of connections between multiple layers within and beyond natural-socio-economic systems? Our economic models are deeply dependent on the rest of the ecosystem, involving human and non-human communities and the interaction of things. However, our recent economic models do not seem to reflect much or any of these concerns. Therefore, are we yet to face multiple levels and various waves of undefined environmental and economic crises?

3. Research Discussion

To address the question of multiple layers within a systemic approach, this research had a "poly-disciplinary" (inter, trans, cross-disciplinary), (Nousala et al., 2012) focus, to expose any possible new emergent drivers that lead to understanding the critical impact and application of knowledge network structures that continuously impacted socio-economic systems.
The research approach investigated knowledge networks and their impact through a comparative analysis focusing on diverse industry clustering within socio-economic systems and relational elements that underpinned various determinant processes and consequences. The analysis promoted understanding as to the bottom-up effects and impacts.

The observations and outcomes from the investigations into the explicit research gaps listed from 1 to 3 formed the basis of the research objectives (through social complex adaptive systems approaches) to gain:

- An understanding of the combination or specific emergent drivers
- An understanding of the behaviour of knowledge flows within systems including knowledge transfer within and between the system

- An understanding of the behaviour of the social or socio aspects of a system in relation to the explicit formal/physical structural behaviours of the economic needs of the complex systems.

By focusing on the critical organizational structures of knowledge networks and their communities of practice (CoP), (Wenger, 1998) this research made significant contributions to achieving urban social and economic wellbeing and longevity beyond the Newtonian system.

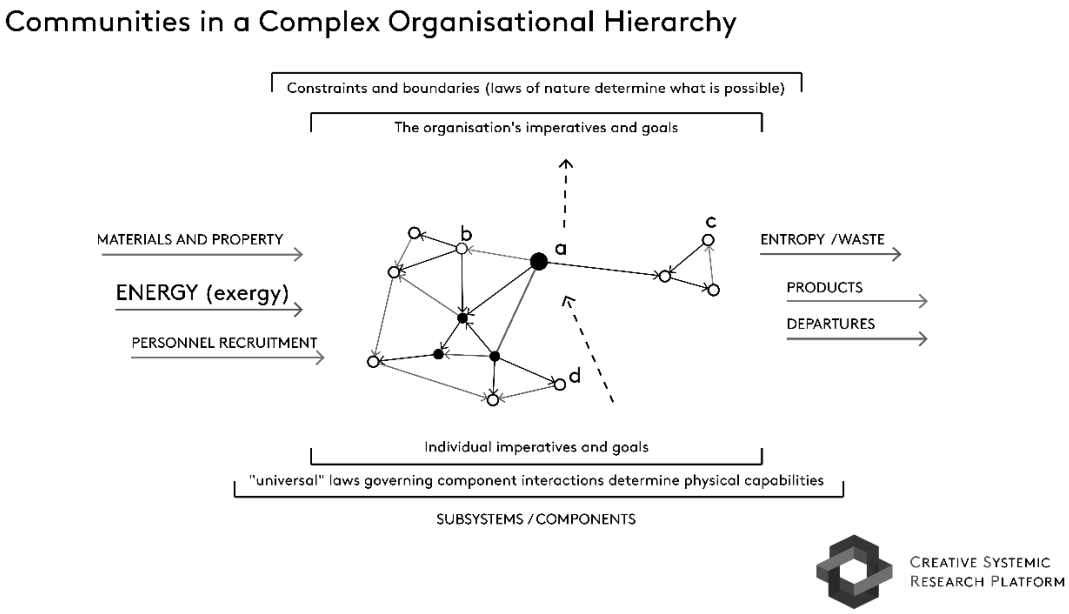

Figure 1: community of practice expressing constrains from top-down laws nature (what is possible) with bottom-up laws governing component, individual imperatives and goals (Cataffo et al., 2019).

4. Previous aims, current concepts and outcomes

The purpose of this work, discussed the methodology that was required for tracking and presenting the value of spatial knowledge and (know-how) flows threads (tacit knowledge networks, TKNs) in a variety of representational forms. The work was also informed by the extensive research and anthropologically based field-work analysis, that focused on a variety of economic eco-systems (Hall et al., 2012; Nousala et al., 2018; Nousala & Hall, 2008). Furthermore, the multi-centered perspective informed the view that an economy is integral not only for human communities but also for other species and elements that have, and are ultimately impacted by extensive financial markets activities. This research, therefore, is also seeking a 'multi-centered design' discussion (Sevaldson, 2018).

Previous multi-perspective understanding of combinations from specific emergent drivers, has helped to highlight the impact of the balance within

communities from the socio-economic and ecological view. This in turn, has lead to the identification of the hidden drivers and the behaviour of knowledge flows within the systems that informed the physical fabric of our societies.

Knowledge networks have also formed the layers on which economic, longitudinal wellbeing found it's a foothold. None of these hidden structures or flows are static, and as mentioned 20 years previously by Huesing and Selhofer (2002), due to the cyclical nature of information itself, the possibilities for creating unbalanced situations impacting digital equity was already well known. Yet very little progress or understanding seems to have been made as we entered the 21st Century.

4.1 Whanganui River: A previous case

The case example of the Whanganui River, provides yet another perspective (though owning person-hood), where the Maori people acted as a community on the river's behalf. As similarly understood by current economic and law models, children are represented by their parents. If this concept were extended, it would be possible for instance, for a dendrologist to act on behalf of a tree and an ornithologist on behalf of a bird in future digital economic models, including blockchain or other token economies that don't require a bank. It would also possible to extend blockchain models and approaches that could provide tangible understanding for intangible societal economic and financial impacts. Continuing the concept (of extending person-hood), what would it mean for the boarder costing of financial market impacts, if full consideration of the detailed layers of whole environmental systems were automatically taken into consideration? Would environmental systems that are so necessary for sustaining humanity and all its activities still be considered irrelevant?

4.2 Prototype investigation for socio-economic and ecological states

An extensive prototype for extending investigation into socio-economic and ecological states, was carried out in the experimental form in 2019 as a design studio unit at Master in Architectural Design program at the Welsh School of Architecture, named, "Synergetic Landscapes" (Davidová & McMeel, 2020). The unit examined real-life experimental aspects of synergy within the urban ecosystem, showing economic strain, within a community in Cardiff, (Part of a larger community-driven Cardiff University project called Cardiff University, 2019). The team had been designing prototypical interventions to extend an edible and habitable landscape across various species. Subsequent designs for prototypes were placed as DIY recipes on a blog (Davidová, 2020), including apps for uploading DIY prototypes onto Google Maps, to assist communities to generate bio-corridors across the neighbourhoods.

During the process, a multi-cantered token system was introduced. Examples of people reproducing prototypical interventions in their front and back gardens were generated by the use of a unique QR code. Location sensitive apps made it possible for people to engage in the local economy, via tokens to receive a coffee in the community cafe or other allied local small medium enterprises (SMEs). This approach, demonstrated how local café owners could facilitate the “payment" for pollinators that are pollinating the community garden, where they grow tomatoes for their sandwiches. Therefore, by DIYing an insect hotel, you produce the service for the café owner.

This ‘real-life co-design laboratory’ (Davidová et al., 2018) from its inception, could produce many more investigations at smaller scale, that could perform and be implemented into larger models. Fundamentally, it demonstrated how values that form socio-economic relationships can and should be created through bottom-up community and societal activities, so as to include the broader costing of financial market impacts. This would be a process that automatically takes into full consideration, the detailed layers of the whole environmental system, were the basis for a different approach to the banking could be developed, beginning with the individual, then the group, society and finally global ecological well being.

4.3 Case Study on Modelling for Peri-urban Communities

The case study and fieldwork discussed here focused on a region called “Xochimilco” on the outskirts of Mexico City, a unique pre-Hispanic, Aztec ecosystem. It could be described as an evolving man-made agricultural/ecological structure of island plots, that currently provides both socio-economic and environmental services to Mexico City. The region provided the basis for research and subsequent elements that led to ontological modelling. Investigations also led to examining the range of constraining dynamic forces of resilient behaviours, and perturbation of the Xochimilco ecosystem (Nousala et al., 2020).

Xochimilco has been described as the breadbasket of the Central Mexican Plateau and was responsible for providing the economic and communication power base from which the Aztec Empire evolved. This area is also known as “the Venice of Mexico”, and is part of a larger metropolis, and part of Mexico City (Wigle, 2014). The traditional land-use patterns of this region were core to the success and development of the Aztec Empire. Briefly, the history of the region informed the basis of understanding including the central role that Xochimilco played, and how the indigenous cultures achieved adaptive co-performance from a holistic stance that included socio-economic, social-ecological views (Nousala et al., 2020). These adaptations over time, became less coherent and more dis-integrated.

Historically, water in the area had been abundant due to natural lake formations in the central plateau. These lakes were central to the developmental phase of agricultural practices, transportation and communication routes throughout the plateau (Banister & Widdifield, 2014). A range of different groups including the Aztecs developed a variety of agricultural ecosystems that had close links to the environmental conditions of the day, including the topography of the region. It is the legacy of these agricultural ecosystems that persist in the Xochimilo area. Specifically, the "chinampa", or reclaimed plots of land, that were constructed on shallow waters of the lake bed, that are still part of the local economic and social activity of family orchards or kitchen gardens (Losada et al., 1998).

However, subsequent actions of past invading powers had the most devastating outcomes. . The draining of the system of lakes to create more habitable land was a long-range disaster (Losada et al., 2015; Zambrano et al., 2010). For a relatively short while, it created an economic boom, called 'Mexican Miracle'. However, Mexico City's population exploded exponentially, and at that moment, the eco-systemic balance was broken. This imbalance also led to a decrease in non-living 'resources', such as water. The example clearly illustrates the need to integrate living and non-living agents within our economies (Nousala et al., 2020).

4.5 Highlighting exclusive/inclusive determinants

When approaching community structures, particularly those that impact accessibility with regards to communication, we can be reminded that these social developments are not just cyclical but longitudinal. Any changes that may occur need to do so, as a balanced approach, towards both the infrastructure that underpins extensive communication around any digital dependent society and the intangibility of the social itself. These tangible and intangible structures need to "grow" at a similar pace, with an equal emphasis placed on both. It has, however, already been noted that this has not been the case, with consequences of the previous concept of the "digital divide" can also be linked to other concepts of intentional or unintentional inequality. Charles Tilly (1998) discussed "opportunity hoarding" which illustrated how groups or organisations excluded others resulting in possible costs to society (not always) but certainly created imbalances within the landscape of social and financial opportunities.

These concepts of imbalance are significant when the question of societal financial communication and land use or other types of wealth or power bases that represent any significant changes to the "*nature and environmental* constraining forces on the established land-use patterns" (Nousala et al., 2020).

Typically, previous adhoc approaches have been prevalent (unwittingly) to the point of creating a patchwork landscape of social digital communication access, with no real possibility of resolving any deeply intertwined and complex problems, with lasting solutions.

Any community or society under strain needs to have a solid base from which to balance the many often constraining needs. With more *diversity* comes the need for high levels of *adaptability* for any system to maintain its integrity to continue functioning. It is relatively easy to overlook the impact that the imbalance of a digital, financial communication platform may unwittingly perpetuate to achieve its goal for higher yields through more sophisticated financial mechanisms.

4.6 Highlighting the processes and consequence

Providing any type of modelling will only ever be representational, however, they are necessary visualizations for comprehension and communication between individuals, groups and societies. The dynamic actions of any system and it's subsequent multiple subsystems are relevant when we want to understand the impacts of the exclusive and inclusive dynamics of societal financial and ecological actions. An ontological model that was developed during field research for a pre-Hispanic site near Mexico City, illustrated various dynamic actions of social, economic and environmental system and it's multiple subsystems. This particular model describes the intangible, emergent forces as, "(a) capacity, (b) robustness and (c) adaptability, as initial *preconditions* with *subsequent behaviours*, with simultaneous external forces from constraints *that function as systemic catalysts of change*" (Nousala et al., 2020).

This type of approach to intangibility that any model illustrates, can inform those analyzing and formulating changes that impact societal structures. The behaviours of complex adaptive systems are by no means visible nor are they predictable, and require at the very least clear definitions, or deep awareness of the function and sub-component features of any social, economic and environmental system in question. It was also clear that any type of corresponding systemic constraints that were revealed during the research of the Mexico City example was identified with, "*natural, socio-cultural, and political-economic constraints".*

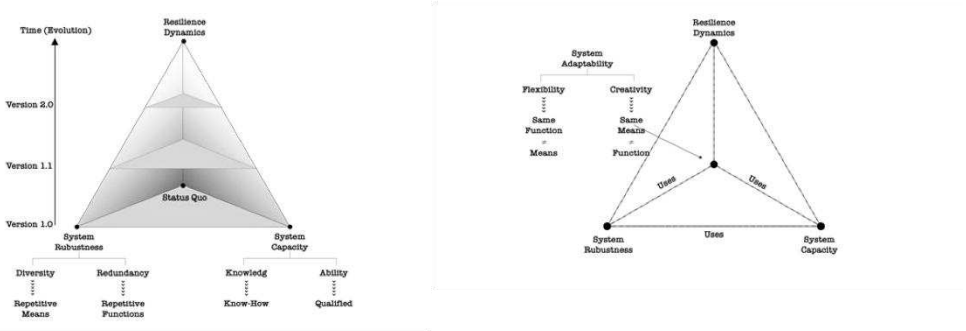

Figure 2: A research example that presents an ontological model, to communicate the impact of dynamic preconditions for societal impacts including social, economic and environmental (Nousala et al., 2020).

5. Developing an Approach

The development of an approach was informed by an extensive review of the material, literature and 24 months of fieldwork observations which included experiences through focused workshops, and discussions on multiple levels and perspectives (ranging from individual to group to community and societal). Specifically, focus groups and participants included local government, businesses, individuals, scholars, students and NGO members. All of these activities were repeated multiple times over two years (Biggs et al., 2015; Cataffo et al., 2019; Hall et al., 2012; Nousala et al., 2009, 2018, 2020; Nousala & Hall, 2008; Walker et al., 2006)

While this approach does not embrace the type of top-down empirical settings, it does support work from the standpoint of a longitudinal, bottom-up base. This approach also helps to emphasis and extrapolates intangible observations, necessary for explanations for any emergent, pre-conditions that would assist with understanding towards socio-economic and environmental relationships at a later date. These findings highlighted through longitudinal view points, the imbalances between external and internal processes, impact and determinants (Biggs et al., 2015; Cataffo et al., 2019; Hall et al., 2012; Nousala et al., 2009, 2018, 2020; Nousala & Hall, 2008; Walker et al., 2006).

The emphasis on the qualitative approach (but not exclusively) proved to be a useful direction from the start. This direction also helped to bind the inter/multidisciplinary and trans and multi-centered approaches towards the working teams involved, whose disciplines ranged from engineering, agriculture, biology, social systems, culture, business and design. The focused, longitudinal observations also made it easier to highlight the emergent themes and patterns that eventually led to the discussions regarding the pre-conditions, and "dynamic forces" (Nousala et al., 2020), that also informed the thinking around the external and internal (exclusive

and inclusive) processes and the impact of subsequent determinants. The key interest of the clusters that formed around certain topics highlighted the longitudinal focus of balancing between past and present elements that contributed to robust or resilient behaviours around the socio-economic, social and environmental.
Ultimately, the understanding of temporal relationships in relation to transition between current and future states would be critical. Yet, while this may seem obvious, most socio-economic considerations are not displaying awareness of these factors.

6. Conclusion

The impact on any societal, or community-based group (human as well as non-human) that is constantly grappling with change is primarily under the constrains that impact the immediate ecological, technological driven outcomes (Cataffo et al., 2019; Hall et al., 2012; Lyon, 2014; Nousala et al., 2020). It is perhaps preferable to adopt not just a longitudinal approach, but one that embraces a broader, holistic view that cannot predict but inform societal shift to include and encourage growth or change that accounts for a balance between the social and the technological across the species and other non-living agents. Without any consideration in this direction and thinking, there can be no change towards the impacts of the financial mechanisms from those that have the access, power and networks to benefit the most. Therefore, we need to focus on building these systems that are distributed and bottom-up.

Unfortunately, we are not far enough evolved with non-human communication to develop such systems where all stakeholders are able to act equally, without representation. We were not able to develop this even for human children where the parent or the society needs to act on their behalf. Acritical example here is Future Generation Act of Welsh Government where 'The Well-being of Future Generations Act requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as poverty, health inequalities and climate change' (Future Generation Commissioner for Wales, 2015).

As discussed by Nousala et al. (2020), obviously it does not mean that any current directions or choices need to be put on hold or ignored until some perfect solutions are found in the far off future. The possibilities for finding balance for the societal, social, economic and environmental are ones that have longitudinal perspectives built-in and encourage balanced actions as a natural way to approach collective prosperity and wellbeing. This awareness for a balanced approach emphasizes a range of perspectives and a deep awareness of the possible preconditions that are continuously being

triggered at ground level, whilst impacting current and future conditions for Planetary Health.

Inter/multidisciplinary and trans/multi-centred or any approach that offers a broader perspective can contribute to supporting societal economic balance that can achieve better integration of social-economic, social and environmental issues, with providing a "voice" or person-hood, where necessary. We suggest that these creations combine bottom-up and top-down approaches. Representational modelling for visualising and co-creating multiple perspectives is an approach that enhances the balance necessary for the external and internal determinants for the natural-socio-economic fabric of societies. Future investigations need to focus on different focal points that show how the impact is holistic connectivity on a continuous basis (Simon, 1962). We need flexibility, where we are able to zoom in and out, creating synergism between multiple communities and their local specifications, ranging from ecosystems to biosphere.

7. Acknowledgments

The authors kindly thank Risa Blair, for the peer-editing and the final proofreading of this article.

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